^{8}Be Nuclear Data Evaluation

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A re-analysis of two-body strong reactions leading to the ^{8}Be intermediate state was motivated by large discrepancies between various evaluations (Fig. 1).

An R-matrix analysis of experimental nuclear data on the reactions ^{4}He(α,α), ^{4}He(α,p), ^{4}He(α,d), ^{7}Li(p,α), ^{7}Li(p,p), ^{7}Li(p,n), ^{7}Be(n,p), ^{6}Li(d,α), ^{6}Li(d,p), ^{6}Li(d,n), and ^{6}Li(d,d), leading to the ^{8}Be intermediate state, has been completed in the last two years. About 4700 data points from 69 experimental references are included. The excitation energy above the ^{8}Be ground state is 25–26 MeV for all reactions except ^{4}He(α,α) and ^{7}Be(n, p). The data for the reactions ^{4}He(α,α) and ^{6}Li(d,d) do not fit well, but the other reactions fit with a χ^2/(point) of less than the overall value of 7.9. Most of the 19 resonances found in the R-matrix analysis correspond to resonances formerly known from experiment. Evaluated cross-section and angular dependence files in ENDF format were prepared for the twelve reactions p^{7}Li, n^{7}Be, d^{6}Li→α^{4}He, p^{7}Li, n^{7}Be, d^{6}Li. Maxwellian averaged temperature-dependent crosssections in nuclear data interface (NDI) format were prepared for the six reactions ^{7}Li(p,α), ^{7}Li(p,n), ^{7}Be(n,p), ^{6}Li(d,α), ^{6}Li(d,p), and ^{6}Li(d,n).

Figure 2 indicates the ^{6}Li(d,p) cross-section obtained in the 2004 R-matrix analysis. Figure 2 should be compared with the former situation depicted in Fig. 1. Figure 3 shows the ^{6}Li(d,α) reaction. Details of the 2004 analysis are available in [1].

[1] P.R. Page, LANL Memo T-16: NW-18/6-04, "^{8}Be Nuclear Data Evaluation," pp. 1–28.

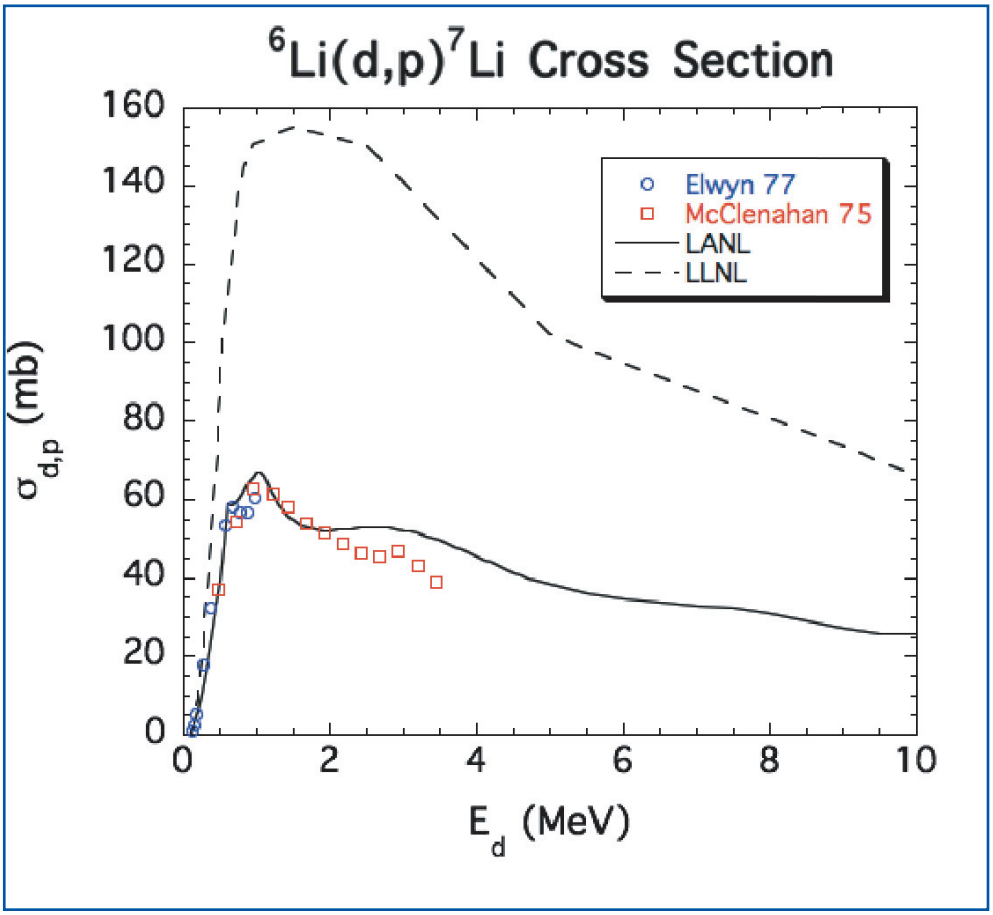

***Figure 1—** Comparison of Los Alamos National Laboratory (LANL) and Lawrence Livermore National Laboratory (LLNL) ^{6}Li(d,p) cross-sections before the current analysis was started and two sets of experimental data. The cross-section is in millibarns up to a deuteron laboratory energy E_d of 10 MeV.*

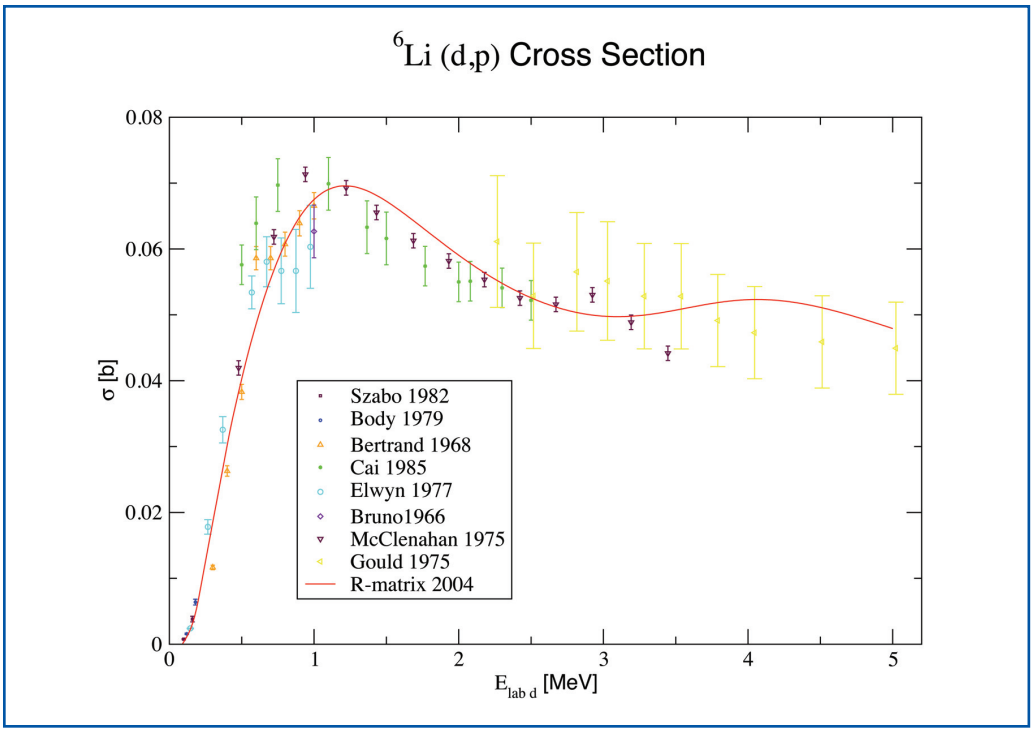

Figure 2—
The 2004 R-matrix analysis cross-section in barns for the ^{6}Li(d,p) reaction up to a deuteron laboratory energy $E_{lab\ d}$ of 5 MeV, corresponding to the excitation energy of this analysis, with eight of the sets of experimental data entered in the analysis.

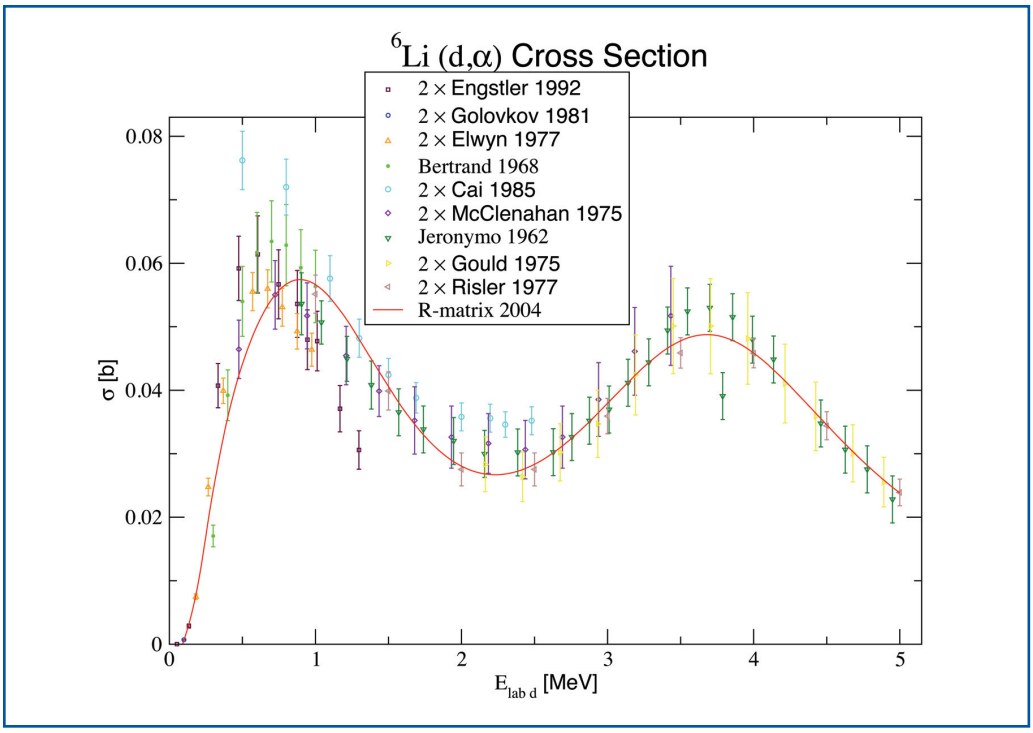

Figure 3—
Same as Fig. 2, except that this is for the ^{6}Li(d,α) reaction. This cross-section should be divided by 2 to obtain a reaction cross-section, since there are identical final α particles.